High air pollution in Denmark may impact children's academic performance

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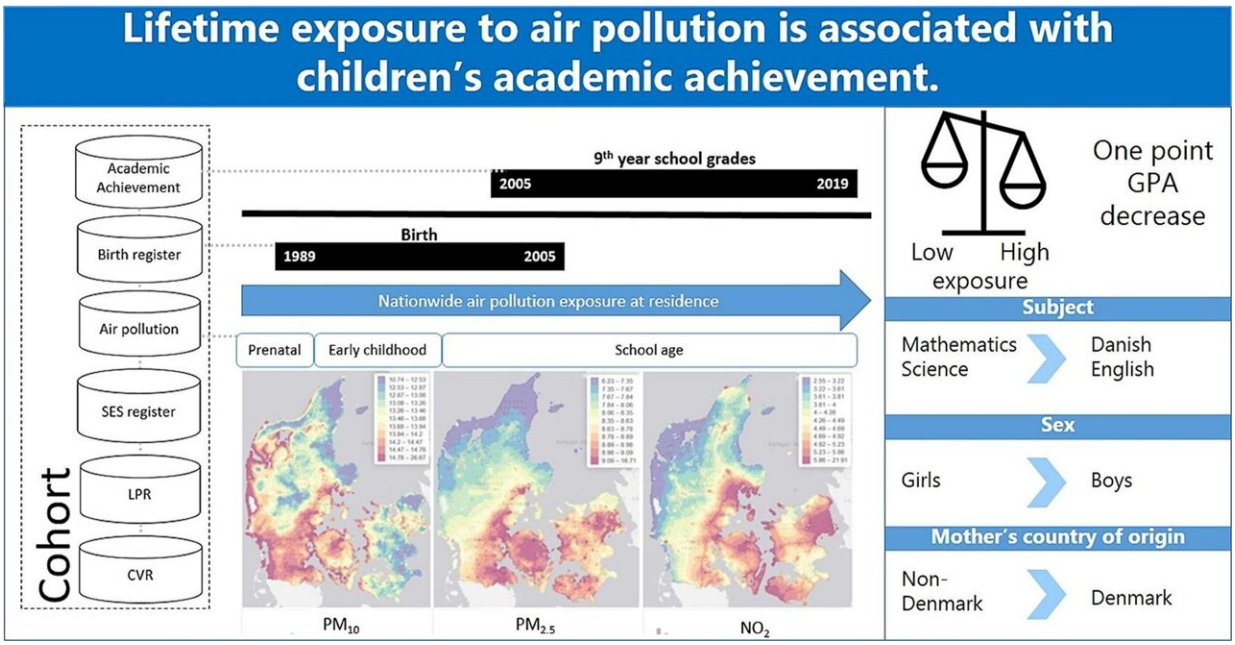

Credit: *Environment International* (2024). DOI: 10.1016/j.envint.2024.108500

Pollution from traffic, farming and wood stoves may have a negative effect on children's cognitive development, according to a new study published in *Environment International* on Danish students' performance in the lower secondary school leaving examination.

You probably don't think about it, but in most parts of the country the air we breathe is anything but clean.

In most parts of Denmark air pollution is double the recommended WHO level, with the highest levels found in heavily trafficked cities and southern Denmark, which is affected by polluted air blowing in from the south.

And polluted air can affect our health, previous research has shown. In fact, air pollution is associated with increased risk of respiratory and cardiovascular disease, and in children air pollution can cause asthma and respiratory infections.

Now a new cohort study from the University of Copenhagen shows that air pollution may also affect students' performance in the primary school final examination. The study included 800,000 lower secondary school students.

One of the researchers behind the new study is Associate Professor Youn-Hee Lim from the Department of Public Health, who is an expert on large cohort studies.

"A comparison of children who have been exposed to air pollution below the recommended level with children who have been exposed to air pollution above the safe level shows a significant difference in performance at the primary school examination," Youn-Hee Lim explains.

In fact, children living at the least polluted addresses exceed the children living at addresses with the highest pollution levels by one full grade point for the average of all five subjects in the exam, she explains.

The researchers stress that they are unable to directly prove a causal link and thus conclude with absolute certainty that air pollution leads to lower marks. What they have done is identify a strong association between air pollution and performance at the primary school final examination, and

they have accounted for family socioeconomic factors, parent's education, etc., leaving alternative explanations for this associations very unlikely.

"We cannot be certain that there is a causal connection between air pollution and academic performance, but within our epidemiological field of research this type of study is the gold standard and the highest level of certainty one can achieve.

"And our results are supported by other international experimental and epidemiological studies, which show that air pollution can impair children's cognitive development," Professor Zorana Jovanovic Andersen says.

"It is a unique study, as we in Denmark have access to data from school performance records for all students in Denmark, and air pollution data at their address, allowing us to conduct a nationwide study on air pollution and cognitive performance. No one has been able to or done this before."

What the researchers did

The study looked at the type of air pollution known as fine particulate matter, more specifically $PM_{2.5}$ pollution.

The researchers examined 800,000 Danish primary school students' grade point average (GPA) in the exit examination linking students' residential exposure to fine particle matter air pollution.

The study showed that children living at the least polluted addresses exceed the children living at addresses with the highest pollution levels by one full grade point for the average of all five subjects in the exam.

To avoid bias, they only compared students within the same school, and then added all the results from the many schools in Denmark together.

Finally, the study considered a series of variables in the model, including socioeconomic background based on the mother's level of education and income, maternal age, mother's country of origin, and parity.

Wood burning, traffic, and agriculture

According to the WHO, the safety level for the so-called $PM_{2.5}$ air pollution, which is the one used in this study, is 5 microgram per cubic meter, but most parts of the country show a level of 11 or 12 microgram per cubic meter.

"The pollution recorded in Denmark is mainly a result of what comes from other parts of Europe and local sources in particular wood burning, traffic, and agriculture," Professor Steffen Loft explains.

According to the researchers, the results of the study clearly suggest that air pollution affects children's cognitive development.

"We have used the students' performance at the primary school final examination as a marker for cognitive development, and the connection between air pollution and poorer academic performance suggests that the children's cognitive development has been negatively affected by air pollution, which is really concerning to see at the level of pollution we have in Denmark," Jovanovic Andersen explains.

According to the researchers, this is problematic—for several reasons. First, poorer cognitive development is associated with poorer health in general.

"Second, poorer cognitive development affects the level of education

and income in adulthood. In other words, it does not simply affect their health, but their entire life and society as a whole," Jovanovic Andersen concludes.

The researchers stress that structural changes in our way of polluting is necessary for the health of people in Denmark and the rest of Europe.

More information: Youn-Hee Lim et al, Lifetime exposure to air pollution and academic achievement: A nationwide cohort study in Denmark, *Environment International* (2024). DOI: 10.1016/j.envint.2024.108500

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